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A CASE OF INTRAUTERINE EPIDEMIC CEREBRO-SPINAL MENINGITIS.*

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IN my investigation of an epidemic of cerebrospinal meningitis during the past winter and spring, I had the good fortune to see many interesting cases in my wards at the St. Louis City hospital. The reports of these cases have already been presented to this association.[1] Among the 34 cases which I studied, there was one which was of the very highest interest, both because it was rare and because it brings to mind the fact that the physiology and pathology of antenatal life are becoming more clearly understood by reason of the very fact that we are meeting with cases of transmission of disease in utero more frequently than ever before. The case to which I refer was the twelfth case in the epidemic. Her history follows :

L. L., a married woman of 31 years, with a good family and personal history, was brought to the hospital on February 24, 1899, at 6.10 A.M. Her husband informed me that the sanitary conditions to which she was subjected in her daily life were bad. She was 7 months pregnant. Two days before coming to the hospital she noticed a pain in the left ear. After using all the household remedies in vain, she sought relief from her pain by going to a physician, who injected something into her ear. Her condition did not improve, and on the following evening she became comatose and was brought to the hospital in that state. Examination showed that she was a woman of good physique and that she was pregnant. No fetal heart-sounds could be heard and the fetus could easily be pushed from side to side. Vaginal

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examination revealed a soft, undilated os. Respirations were somewhat laborious; pulse rapid and weak, 120; temperature 102° F. Pupils were unequal, left pupil smaller than right. Kernig's sign was present. There was marked difficulty of deglutition when food was offered. Hyperesthesia was evident by quick response to mechanical stimuli. The head was drawn back. On touching the spine or the back of the neck, patient would come out of her coma for a moment or two and mutter deliriously. Photophobia was also marked. On inspection of the skin, a petchial eruption was found to be somewhat unevenly distributed over the upper part of the chest, both anteriorly and posteriorly. Tâche cerebrale was manifest by streaking the skin. As observed in nearly all cases of epidemic cerebrospinal meningitis, instability of the pupil was present.

Urinary analysis: (A.M.) single specimen, specific gravity 1030; acid; no albumins, no sugar, no casts, no bile.

The patient steadily declined, becoming delirious from time to time; complained at times of severe occipital pains in her moments of partial consciousness. Urinary analysis: (P.M.) single specimen, specific gravity 1021; acid; about $\frac{1}{5}$% albumins; $\frac{1}{2}$% sugar, estimated by Einhorn's saccharometer tube and by phenylhydrazin test. Temperature in evening was 103° F. Her condition was no better on the following day; pulse weaker; temperature had risen to 105° and she died at 4.45 A.M.

Necropsy was held 5 hours after death and the following conditions were found: Rigor mortis marked; usual changes of pregnancy present, *i. e*, discoloration of nipples and face; enlargement of breasts; enlarged abdomen; enlarged veins upon abdomen, etc. A 7-months' fetus was removed from the uterus by abdominal incision. The uterus was found to be in the state common to pregnancy of that duration, with no signs of abortion or perititonitis. The placenta had a median attachment; no lesion could be made out. The lungs showed signs of hypostatic congestion; heart was slightly enlarged but there were no valvular lesions. The diaphragm was pushed up on the left side to third interspace and to the fourth on the right side. The kidneys showed changes in the shape of an acute parenchymatous nephritis. Spleen was enlarged but not soft. The liver appeared to show nothing pathologic. Uterus and adenexa presented changes common to pregnancy. On opening the cranial cavity of the mother, a typical meningitis was found; there was great injection of the vessels of the pia arachnoid and an abundant purulent exudation scattered here and there over the entire meningeal surfaces, particularly at the base The same condition was found upon the cord. An exact counterpart of the condition of the maternal meninges was found in the fetus, with perhaps more of a sero-purulent exudation than a purely purulent exudation as found in the mother.

Bacteriologic examination of fluid from both the maternal and fetal meninges revealed the presence of the diplococcus intracellularis meningitidis. The same microorganism was also separated in pure culture from the left ear of the mother. This ear contained pus in small quantity. Cultures taken from the lungs, blood, placenta and uterus were barren of growth. A dog was inoculated with pure culture obtained from the maternal meninges and it died on the fifth day following the inoculation, in convulsions. Another dog was inoculated with cultures obtained from the fetus of the above woman and it died two days thereafter in convulsions, as did another dog which was inoculated with cultures obtained from the ear of the mother. In this way the pathogenesis of the microorganisms from three different sources was clearly proved.

Pathologically, the maternal and fetal meninges, cerebral and spinal cord tissue exhibited about the same condition of inflammation and degeneration such as is found in epidemic cerebrospinal meningitis. This has been fully described by me in my general report of the disease.[4] There were widespread purulent infiltration of the cerebral and cord tissue with the degeneration of the cells in the anterior portion of the cord, and likewise a degeneration of the cranial and some of the spinal nerves. The auditory and optic nerves seemed to have received the brunt of the infection.

From what has already been said it can be seen that I was dealing with a case of intrauterine epidemic cerebrospinal meningitis. In looking over the literature upon the transmission of disease in utero and particularly upon the transmission of the so-called specific infectious diseases in utero, I find that no record has ever been made of a parallel case, *i. e.*, of a case of epidemic cerebrospinal meningitis in utero. It is already clinically known that syphilis, variola,

scarlatina, and measles can be transmitted from the mother to the fetus in utero. W. Fordyce[1] has reported a case of intrauterine typhoid fever in which the bacillus typhosus was demonstrated in the fetus, and in which also Widal's reaction was positive. Similar observations have been previously made in regard to intrauterine typhoid fever by Reher, Neuhass and Eberth, in 1893. It is to be borne in mind that the case I cite is a case of *epidemic* cerebrospinal meningitis transmitted in utero. The only case that bears any semblance to it and that has been reported is one of Herwerden.[2] Herwerden relates the case of a woman who died with *sporadic* meningitis in an advanced stage of pregnancy. Cesarean section was performed. The child lived five days and then died of meningitis complicated with pleurisy. In the meningeal exudation of both the mother and child, and also in their blood and liver, pneumococci were found. The virulency of the pneumococci appeared to be very slight at first, but it was increased by submitting them to the action of hydrogen and oxygen, so that inoculation into rabbits produced meningitis. No mention is made in this case of the existence of a lesion of the placenta. The points of difference between Herwerden's case and mine are striking : in the first place, his case was probably one of *sporadic* cerebrospinal meningitis, as it was caused by the pneumococcus, while my case was one of *epidemic* cerebrospinal meningitis. In the report of his case, he says that the child showed symptoms of meningitis some time after removal from the maternal parts, and does not mention whether the symptoms were present at time of delivery. Indeed, it would not be possible to say that this was a case of transmission of the disease in utero, because he had no evidence that a meningitis existed at the time of delivery of the child. It is reasonable to suppose that the child became subse-

quently infected with meningitis after birth. However, it would be difficult to prove either assumption in the absence of a more complete report of Herwerden's case. It is referred to only as part of the literature upon this subject of meningitis transmitted in utero.

The question now arises as to the manner in which a specific microorganism can pass from the mother to the fetus and attack some special part of the body, such as the small intestine in typhoid fever or the meninges in meningitis. This brings us to the physiology and pathology of antenatal life. Ballantyne[3] describes the physiology of antenatal life, dividing it into these three periods: (1) *Germinal life*, about which little is known in the human subject, the period which ends in the mysterious phenomena of maturation of germ and sperm, of the expulsion of the polar globule from the ovum, of the atrophy of the female element of the cell and of the impregnation of the ovum by the spermatozoon, with the resulting formation of the morula-mass. (2) *Embryonic life*, the period beginning with the differentiation of the blastoderm and ending about the end of the second month, the period of evolution or development during which the lines of future growth are laid down. (3) *Fetal life*, the period in which the organism shows its vitality chiefly by growth along lines which have already been definitely laid down.

Ballantyne said that a prolonged study of antenatal pathology has led him to the belief that the fetus is liable to the same diseases as the infant, the child, and the adult. It enjoys partial immunity from parasitic skin-diseases. Fetal maladies differ from those of adult life by reason of the fact that the fetus has a different environment; thus, in fetal variola, the face is not marked because the skin of the fetus is kept moist and is not under the deleterious influence of light and

air. Infection of the fetus from the mother occurs in one of two ways, *i. e.*, either by means of the blood-stream or by means of the amniotic fluid which is swallowed by the fetus. Intrauterine typhoid fever, when there are no intestinal lesions, is probably transmitted in the latter way. The case which I have recorded may have been infected in either way.

It has been said that disease is transmitted in utero by way of the placenta only when there is some placental lesion, because ordinarily the fetal villi form a barrier of protection for the fetus against the encroachment of pathogenic bacteria. The experiments of Arloing, Cornivix, Thomas and others have shown us that this is not always true, and that the specific microorganisms of chicken-cholera, tuberculosis, glanders, septicemia, recurrent fever, erysipelas, and anthrax can pass from the mother to the fetus in the absence of a lesion of that organ. However, we must take into consideration the extreme difficulty of locating a very minute lesion of the placenta. In whatever way the specific microorganism may gain access to the fetal tissues from the mother, it can be said that in a disease like typhoid fever or epidemic cerebrospinal meningitis, there must surely be some selective affinity on the part of the microorganism for some tissues, such as the lining of the small intestine offers to the bacillus typhosus or the pia arachnoid offers to the diplococcus intracellularis meningitidis. It is a biochemical phenomenon, dependent upon the affinity of the molecules of the meningeal tissues for the molecule of the microorganism.

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[3] Ballantyne: *Brit. Med. Jour.*, June, 1898; *Am. Year Book*, 1899. Councilman, Mallory and Wright, *et al.*
[4] *Philadelphia Monthly Medical Journal*, July, 1899.